Delayed Onset Muscle Soreness Induced Changes to Running Kinematics and the Influence of a Topical Analgesic

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Summary

The purpose of this study was to evaluate the effects of a menthol-based topical analgesic on DOMS induced changes to running kinematics and pain perception. 3D kinematics of the lower extremity were recorded while running at 2.5, 3.0 and 3.5m/s. Lower extremity kinematics were measured at three time points, including: baseline, after DOMS-inducing protocol and intervention (Biofreeze® or placebo). Results demonstrate that maximum knee flexion angle increased as speed increased. After the intervention, maximum knee flexion angle from middle to high speed was greater in the Biofreeze® group.

Introduction

Gradual changes in running kinematics could alter lower extremity joint loading, contributing to tissue damage or performance impairments. One mechanism for changes in running kinematics could be attributed to delayed onset muscle soreness (DOMS). DOMS is associated with discomfort and leads to modified movement patterns as individuals compensate for affected muscles [1]. Research has shown increased vertical leg stiffness when running with DOMS [2]. This could be a neuromuscular strategy to off-load the compromised muscles, but at the expense of ground reaction forces [2]. A topical analgesic can alleviate musculoskeletal pain [3]. However, its effects on DOMS-related discomfort and running kinematics remain unclear. The purpose of this study was to evaluate the effects of a menthol-based topical analgesic on DOMS induced changes to running kinematics and pain perception.

Methods

12 experienced runners (>20km/week) with no lower extremity injuries were placed into 2 groups: 1) Biofreeze® (Performance Health, Akron, OH) and 2) Placebo. There were 2 experimental sessions, and all runs were completed on a treadmill. For session 1, participants completed a baseline (BASE) run followed by a DOMS-inducing protocol (-10° decline, 30-minutes at ~85% of heart rate maximum). 48 hours later, participants returned to the lab for session 2, which included a run with DOMS (DOMS) followed by an intervention (INT). For the INT, participants rested for 15 minutes while Biofreeze® (BIOF) or a placebo (PLAC) were applied to the plantar flexor and knee extensor muscles. For all trials, participants ran at 3 randomized speeds (2.5, 3.0 and 3.5m/s) for 2 minutes each. At the start of each session, pain pressure threshold (PPT) was measured bilaterally at the myotendinous junction of the vastus medialis oblique and the gastrocnemius-achilles complex (Wagner Pressure Guage, Greenwich, CT). During each session, 3D kinematics of the lower extremity were measured using a 10-camera motion capture system (Vicon, Oxford, UK) at 120 Hz. Heel strike was determined for each stride and kinematic data normalized to % of gait cycle. Friedman test was used and α was set at 0.05.

Results and Discussion

DOMS-inducing protocol running speed ranged from 3.6 to 5.4 m/s. Both left and right PPT locations showed a significant decrease after the DOMS-inducing protocol and increased after the intervention application. For the Biofreeze® group, maximum knee flexion increased from the slowest to fastest speed in BASE (77.7 ± 6.2° to 94.0 ± 11.9°), DOMS (76.0 ± 6.8° to 92.7 ± 13.6°) and BIOF (78.9 ± 10.2° to 95.9 ± 12.1°). Similar results were found in the placebo group (BASE: 75.8 ± 3.7° to 92.8 ± 5.2°, DOMS: 76.5 ± 3.5° to 94.8 ± 3.8° and PLAC: 77.9 ± 4.7° to 93.7 ± 8.8°). As speed increased, the body needs greater force and kinetic energy to counteract external resistance and gravity, leading to an increase in knee flexion. After intervention, increases were also found in maximum knee flexion from middle to fastest speed (BIOF: 83.8 ± 13.1° to 95.9 ± 12.1°, PLAC: 85.2 ± 3.4° to 93.7 ± 8.8°).

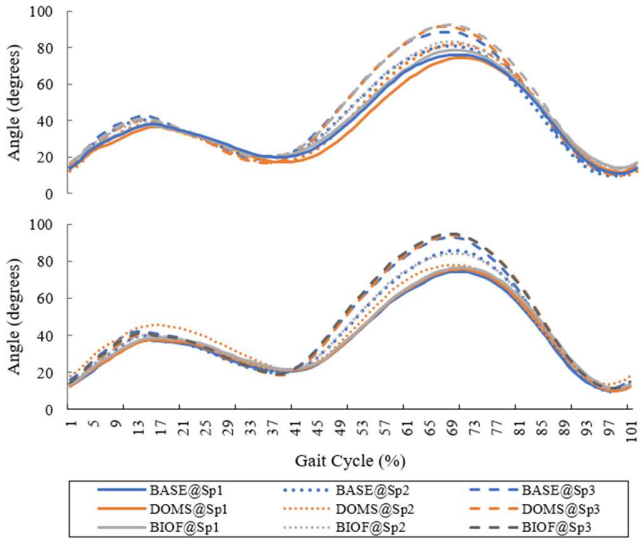

Figure 1: Right knee angle (degrees) normalized to gait cycle for the Biofreeze® (top) and Placebo (bottom) groups across run speeds.

Conclusions

Maximum knee flexion angle increased as speed increased, however, peak flexion may not be a sensitive indicator of DOMS induced changes in running kinematics. Next steps will examine hip and angle angles, velocities and joint coordination strategies through the entire gait cycle.

Acknowledgments

This project was supported by Performance Health.

References

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